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Your Petitioner, Murray Kutler, citizen of the United States of America and resident of the State of Nebraska, whose residence and mailing address is 2119 South 135th Avenue, Omaha, Nebraska 68144, prays that Letters Patent Protection be granted to him for a

SUPPORT AND ENCLOSURE STRUCTURE FOR FLUORESCENT LIGHT BULBS

as set forth in the following specification:

Background of the Invention

1. Technical Field

The present invention relates generally to support devices for lights and, more particularly, to a support and enclosure structure for fluorescent light bulbs which includes an elongated hollow tube having opposite ends, an outer wall and an inner volume, at least one ventilation opening extending through the outer wall for permitting air flow between the inner volume of the tube and the surrounding environment for cooling of the fluorescent light bulb held within the tube, end caps mounted on opposite ends of the tube which engage the opposite ends of a fluorescent light bulb and support the light bulb within the inner volume of the tube free of contact with the outer wall of the tube and the tube being constructed of a generally rigid, at least partially translucent material such that light emitted by the fluorescent light bulb is viewable through the outer wall of the elongated hollow tube.

2. Description of the Prior Art

Fluorescent lights are used in many different situations for lighting purposes. In general, the standard fluorescent lamp design includes a generally hollow airtight glass tube which is filled with an inert gas such as Argon with the outer wall of the glass tube being coated with a phosphor substance and further includes a pair of electrodes mounted at opposite ends of the airtight tube. When the fluorescent light is turned on and current is passed through the electrodes, both electrode filaments heat up very quickly, boiling off electrons, which ionize the gas in the tube, thus establishing an electrical arc which excites mercury atoms held within the tube, thus triggering the illumination process. Of course, there are other types of fluorescent light bulbs and fluorescent light fixtures, but each of them have in common a phosphor-coded translucent glass tube in which the inert gas is held. The problem with most fluorescent lights, and, in particular, fluorescent light bulbs, is this glass tube which is very prone to breakage during installation or removal of the fluorescent bulb from the fluorescent light fixture. There is therefore a need for a support and protection structure which can be used in connection with fluorescent light bulbs to provide an easy-to-handle structure which may be quickly and easily fitted into a light fixture while significantly reducing the chance for breakage of the bulb.

Another problem encountered in the use of fluorescent light bulbs is the excessive amount of heat which can be emitted by the bulb, particularly in the case of the currently available high-intensity fluorescent light bulbs. Unless the heat generated by

the bulb is allowed to dissipate, the lifespan of the fluorescent bulb may be severely compromised which detracts from the usefulness of the fluorescent bulb and makes operation of the unit that much more expensive. It has further been found that the heat dissipation problems encountered with fluorescent light bulbs being used with standard lighting fixtures are exacerbated when the air space surrounding the light bulb is restricted, as would occur if the bulb were contained within a protective enclosure or the like. There is therefore a need for ventilation openings in the walls of any enclosing structure which will permit the heat generated by the high-intensity fluorescent bulb to be quickly and easily dissipated. Another beneficial feature of fluorescent bulbs is that they may be, in general, quickly and easily removed and replaced upon the bulb burning out. However, removal and replacement of the fluorescent bulb entails some degree of danger due to the elongated glass tube which comprises the fluorescent light bulb, as the elongated glass tube is easily shattered and broken by any type of contact or excessive stress. Furthermore, the ease with which the fluorescent light bulb may be removed and replaced is almost entirely dependent on the location of the fluorescent light fixture, and, in the event of the fluorescent light fixture being in a fairly inaccessible area, removal and replacement of a bulb can be very difficult. Removal and replacement of the bulb is facilitated, however, if the connection of the bulb to the light fixture is improved and, furthermore, the removal and replacement of the fluorescent bulb is greatly simplified if a connection to the fluorescent fixture ballast is made easier. There is therefore a need for a support and

enclosure structure for a fluorescent light bulb which can be quickly and easily removed from a light fixture and which may be quickly and easily connected to the ballast of the light fixture once the fluorescent bulb is mounted within the light fixture.

Therefore, an object of the present invention is to provide an improved support and enclosure structure for fluorescent lights.

Another object of the present invention is to provide a support and enclosure structure for fluorescent lights which includes an elongated hollow tube having opposite ends, an outer wall and an inner volume and end caps which mount to opposite ends of the hollow tube, the end caps engaging and supporting a fluorescent light bulb therebetween to support the light bulb within the inner volume of the hollow tube without contacting the outer wall of the tube.

Another object of the present invention is to provide a support and enclosure structure for fluorescent lights which includes at least one ventilation opening extending through the outer wall for permitting air flow between the inner volume of the tube and the surrounding environment for cooling of the fluorescent light bulb held there within.

Another object of the present invention is to provide a support and enclosure structure for fluorescent lights which may be quickly and easily mounted within a fluorescent light fixture and which can be connected to the fluorescent light fixture ballast after the support and enclosure structure is mounted therewithin.

Another object of the present invention is to provide a support and enclosure structure for fluorescent lights in which the hollow tube is constructed of a generally rigid, at least partially

translucent material such that light emitted by a fluorescent light bulb held within the tube generally radiates through the outer wall of the tube into the surrounding environment.

Finally, an object of the present invention is to provide a support and enclosure structure for fluorescent lights which is relatively simple to manufacture and is safe and efficient in use.

Summary of the Invention

The present invention provides a support and enclosure structure for fluorescent light bulbs which includes an elongated, hollow tube having opposite ends, an outer wall and an inner volume, and at least one ventilation opening extending through the outer wall for permitting air flow between the inner volume of the tube and the surrounding environment for cooling of the fluorescent light bulb held therewithin. End caps are mounted on opposite ends of the tube, the end caps adapted to engage opposite ends of the fluorescent light bulb and support the fluorescent light bulb within the inner volume of the tube free of contact with the outer wall of the tube. Finally, the tube is constructed of a generally rigid, at least partially translucent material, such that light emitted by the fluorescent light bulb held within the tube generally radiates through the outer wall of the tube into the surrounding environment.

As thus described, the support and enclosure structure for fluorescent light bulbs of the present invention provides a substantial improvement over those protective devices found in the prior art. For example, the support and enclosure structure of the present invention may be quickly and easily removed from the fluorescent light fixture and, once removed, the fluorescent light bulb held there within may be replaced while the support and enclosure structure is in a far more accessible location. Once the bulb is replaced, the support and enclosure structure can then be put back into the fluorescent light fixture, thus greatly facilitating the removal and replacement of the fluorescent light bulb. Also, the ventilation opening extending through the outer

wall of the hollow tube permits air flow between the inner volume of the tube and the surrounding environment, thus cooling the fluorescent light bulb held therewithin which extends the lifespan of the fluorescent light bulb and greatly reduces the risk of fire due to excessive heat caused by the bulb. Finally, because the hollow tube is constructed of a generally rigid material such as plastic or a resin-based material, there is far less concern with breakage of the fluorescent light bulb during installation and removal from the fluorescent light fixture which greatly reduces the chance for injury due to breakage of the bulb. It is thus seen that the support and enclosure structure for fluorescent light bulbs of the present invention provides a substantial improvement over those devices found in the prior art.

Brief Description of the Drawings

Figure **1** is a perspective view of the support and enclosure structure for a fluorescent light bulb of the present invention;

Figure **2** is a side sectional elevational view taken along line 2-2 of Figure **1**;

Figure **3** is a detailed exploded perspective view of the end elements of the support and enclosure structure for fluorescent light bulbs of the present invention;

Figure **4** is a front sectional elevational view of the present invention; and

Figure **5** is a perspective view of an alternative embodiment of the present invention.

Description of the Preferred Embodiment

The support and enclosure structure **10** for fluorescent light bulbs of the present invention is best shown in Figures **1-4** as including an elongated hollow tube **12** which, in the preferred embodiment, would have a length of approximately six inches to four feet, and a diameter of approximately one-half inch to three inches, depending on the bulb size which is to be retained within the support and enclosure structure **10**. The thickness of outer wall **14** would vary accordingly, although in any circumstance it is preferred that the outer wall **14** be of sufficient thickness to provide structural rigidity to the hollow tube **12** to provide appropriate protection for the fluorescent light bulb **50** retained within the hollow tube **12**. It is further preferred that hollow tube **12** be constructed of a sturdy plastic or resin-based material which would be molded into the hollow tube shape by any standard plastic formation technique used in the art. Furthermore, it is preferred that the hollow tube **12** be at least partially translucent to permit the light emitted by the fluorescent light bulb **50** to radiate through the outer wall **14** of hollow tube **12** into the surrounding environment. The precise level of translucence, color, and other light-passing characteristics of the hollow tube **12** may be modified or changed depending on the intended use of the support and enclosure structure **10** of the present invention, any of which would be understood by one skilled in the art of lighting techniques.

In the preferred embodiment, hollow tube **12** would have a generally C-shaped cross sectional shape, as shown best in Figure **2**, with the gap in the outer wall **14** extending between the inner

volume **16** of hollow tube **12** and the surrounding environment. This gap forms the ventilation opening **20** which permits air flow between the inner volume **16** of hollow tube **12** and the surrounding environment, thereby providing cooling for the fluorescent light bulb **50** housed within the hollow tube **12**. As shown in Figure **1**, the ventilation opening **20** extends along the entire length of hollow tube **12**, yet, due to the wall thickness of outer wall **14**, the structural rigidity of the hollow tube **12** is not compromised.

Formed in the outer surface of outer wall **14** and extending along the length of hollow tube **12** is a wire channel **18**, shown best in Figures **2** and **3**, which provides a channel for electrode wire **52** projecting from fluorescent bulb **50** to run back along the hollow tube **12** yet be safely retained adjacent the hollow tube **12** to prevent accidental damage to the electrode wire **52**. Of course, the wire channel **18** is not absolutely necessary to the functioning of the present invention, although it has been found that the inclusion of wire channel **18** greatly decreases the chance for the electrode wire **52** to be damaged. It has further been found that the inclusion of wire channel **18** generally requires a slight thickening of the outer wall **14** on the side of outer wall **14** adjacent inner volume **16**, as shown in Figure **2**, in order to maintain the structural rigidity of the hollow tube **12**. This wire channel ridge **22** may be formed as part of the manufacturing process for hollow tube **12**, or may be added later, although it is preferred that the wire channel ridge **22** be integrally formed with hollow tube **12** in order to maintain the structural rigidity of hollow tube **12**. It should be noted, however, that inclusion of the wire channel ridge **22** is not strictly necessary to maintain the

structural integrity of the hollow tube **12** in the various embodiments of the present invention.

Mounted on opposite ends **24a** and **24b** of hollow tube **12** are a pair of end caps **26a** and **26b**, which are shown best in Figure **3**. As the end caps **26a** and **26b** are generally identical to one another, the following description of end cap **26a** should be understood to apply equally to end cap **26b**. End cap **26a** is formed as a generally cylindrical plug having an external diameter approximately equal to or slightly greater than the internal diameter of hollow tube **12**, and would further include a cut-out section **28** which corresponds with the wire channel ridge **22** as was previously described. The generally cylindrical plug section **30** of end cap **26a** is hollow and includes an electrode opening **32** which extends generally coaxially through cylindrical plug section **30** of end cap **26a**. Mounted on the outer end of cylindrical plug section **30** is a flange **34** which prevents the end cap **26a** from extending too far into the hollow tube **12**. The flange **34** would also include a cut-out section **36** which permits the electric wire **52** to extend therethrough. Perhaps the most important feature of end cap **26a**, however, is that the electrode opening **32** of cylindrical plug section **30** is adapted to engage and support one end of the fluorescent light bulb **50**, as shown best in Figure **4**. It should thus be noted that the electrode opening **32** will be of various diameters depending on the external diameter of the fluorescent light bulb **50** to be supported by the end cap **26a**. Such modifications in the diameter are well within the purview of the present invention and the users thereof.

Assembly of the support and enclosure structure **10** of the present invention is shown best in Figures **3** and **4** as including the

following steps. First, the fluorescent bulb **50** is engaged by one of the end caps **26a** and then the fluorescent light bulb **50** is slid into hollow tube **12** until the end cap **26a** is slid into the inner volume **16** of hollow tube **12** and flange **34** of end cap **26a** engages the end **24a** of hollow tube **12**. The electrode **54** of fluorescent light bulb **50** adjacent end cap **26a** thus extends through electrode opening **32** for eventual engagement by a power source. At the opposite end **24b** of hollow tube **12**, the electrode wire **52** is pulled through the electrode opening **32** of end cap **26b** and end cap **26b** is pushed forwards into hollow tube **12**, thus engaging the opposite end of the fluorescent light bulb such that the fluorescent light bulb **50** is supported by the end caps **26a** and **26b** within hollow tube **12**. The electrode wire **52** thus extends out of electrode opening **32** and would be fed back around and over hollow tube **12** via wire channel **18** to return the electrode wire **52** to be adjacent electrode **54** of fluorescent light bulb **50** for engagement by a power source. A wire channel cover **36** is then adhesively secured over the wire channel **18** to secure the electrode wire **52** within the wire channel **18**, as shown best in Figure **4**. The wire channel cover **36** is preferably a section of adhesive electrical tape which covers the wire channel **18**, although the exact nature of the wire channel cover **36** is not critical to the present invention so long as the electrode wire **52** is retained within the wire channel **18**. The electrode wire **52** and electrode **54** are then connected to a wire harness **60** which is then plugged into the fluorescent light fixture in which the support and enclosure structure **10** of the present invention is to be mounted.

Additional mounting end caps **40a** and **40b**, as shown best in Figures **1** and **3**, are provided which fit over end caps **26a** and **26b**

and onto hollow tube **12** to permit the hollow tube **12** to be mounted within various types of fluorescent light fixtures. Although the mounting end caps **40a** and **40b** are shown as including mounting pins **44**, it should be understood that many different types of mounting structures may be utilized with the present invention so long as the hollow tube **12** is securely mounted within the fluorescent light fixture via the mounting end caps **40a** and **40b**. In fact, in one preferred embodiment of the present invention, the mounting end cap **40a** would include a generally U-shaped slot **42** formed in the side wall of the mounting end cap **40a**, and this slot **42** is aligned with the wire channel **18** to permit the wire harness **60** to extend therethrough to connect to the electrode wire **52** and electrode **54** instead of extending out through the center axis hole in the mounting end cap **40a**. This design permits the use of the present invention in situations where the wire harness **60** cannot extend out through the center axis hole due to the mounting of the present invention within a particular fluorescent light fixture. Of course, other variations of the mounting end caps **40a** and **40b** may be used with the present invention, and in fact these may be eliminated from use with the present invention, depending on the mounting characteristics of the particular fluorescent light fixture with which the present invention is to be used.

Finally, Figure **5** illustrates an alternative embodiment of the ventilation openings **20'** of the support and enclosure structure **10'** of the present invention. The hollow tube **12'** of Figure **5** would include a plurality of circular ventilation openings **20'** spaced along the tube **12'** which extend through outer wall **14'** of hollow tube **12'**. Of course, many different types of ventilation openings

may be used with the present invention so long as the intended purpose of providing ventilation and surrounding air flow for the fluorescent light bulb **50** is maintained.

It is to be understood that numerous additions, substitutions and modifications may be made to the support and enclosure structure **10** for fluorescent light bulbs of the present invention which fall within the intended broad scope of the appended claims. For example, the size, shape, and construction materials used in connection with the present invention may be modified or changed so long as the intended functional features are not degraded nor destroyed. It may also be beneficial to include reflective tape or other such reflective material along one side of the hollow tube **12** to increase the light emission from one side of the hollow tube **12**. Also, the exact size and shape of the end caps **26a** and **26b** may be modified or changed so long as the intended functionality of maintaining the fluorescent light bulb **50** in a suspended state within the inner volume **16** of hollow tube **12** is maintained. Also, the exact size and shape of the mounting end caps **40a** and **40b** may be modified or changed so long as the intended functionality of mounting the fluorescent light bulb **50** within the fluorescent light fixture is accomplished. Finally, as was discussed previously, the size, shape, and number of ventilation openings **20** may be modified or changed so long as the air flow around the fluorescent light bulb **50** is permitted and maintained.

There has therefore been shown and described a support and enclosure structure for fluorescent light bulbs which fulfills all of its intended objectives.